PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference AS/AJD/P13182PC	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/GB2004/004751	International filing date *(day/month/year)* 11.11.2004	Priority date *(day/month/year)* 14.11.2003
International Patent Classification (IPC) or national classification and IPC F04D29/42, F04D29/16, F04D29/62		
Applicant WEIR WARMAN LIMITED et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 10 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
14.09.2005	27.02.2006
Name and mailing address of the international preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Ingelbrecht, P Telephone No. +31 70 340-2256

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/GB2004/004751

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-24	as originally filed

Claims, Numbers

1-53	received on 15.12.2005 with letter of 15.12.2005

Drawings, Sheets

1/10-10/10	as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-53
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-53
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-53
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V.

1 The following documents are referred to in this communication:

D1: US-A-5 427 498 (LEHE ET AL) 27 June 1995 (1995-06-27)
D6: DE 197 18 027 A1 (MIELE & CIE GMBH & CO, 33332 GUETERSLOH, DE; MIELE & CIE. GMBH & CO) 5 November 1998 (1998-11-05)

2 Document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and shows a pump insert to be located within a pump casing and having an inner surface which in use defines a portion of a pump volute, wherein said pump insert is adapted to be coupled with a pump casing by a rotary inter-engaging profiled coupling arrangement.

2.1 The subject-matter of claim 1 differs from this known pump insert in that in use the pump insert is adapted to secure a pump casing closure element between the pump insert and the pump casing.

2.2 The subject-matter of claim 1 is therefore new (Article 33(2) PCT).

2.3 The problem to be solved by the present invention may be regarded as a difficult assembly procedure.

2.4 The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

2.5 Although document D6 discloses a pump closure structure in which a pump insert is held in coupling engagement between a pump casing and a pump closure member which are coupled using a rotary inter-engaging profiled coupling arrangement. It is not obvious to the skilled person how he should modify the design of the pump disclosed in document D1 to include this design feature, as the pump insert in document D1 is on the front side rather than on the back side of the impeller as is the

case in document D6.

3. The same reasoning applies, mutatis mutandis, to the subject-matter of the corresponding independent claims 36, 44, 47 and 50, which therefore are also considered new and inventive.

4. Claims 2-35, 37-43, 45-46, 48,49 and 51-53 are dependent claims and as such also meet the requirements of the PCT with respect to novelty and inventive step.

CLAIMS:

1. A pump insert to be located within a pump casing and having an inner surface which in use defines a portion of a pump volute, wherein said pump insert is adapted to be coupled with a pump casing by an inter-engaging profiled coupling arrangement, and wherein said pump insert, in use, is adapted to secure a pump casing closure element between the pump insert and the pump casing.

2. A pump insert as claimed in claim 1, wherein a portion of the pump insert is adapted to be secured against a portion of the pump casing closure element.

3. A pump insert as claimed in claim 1 or 2, wherein the pump insert is adapted to be clamped between the pump casing and the pump casing closure element during assembly of the pump.

4. A pump insert as claimed in claim 1, 2 or 3, wherein the pump insert is adapted to be clamped between a pump liner and the pump casing closure element.

5. A pump insert as claimed in claim 1, 2, 3 or 4, wherein the pump casing closure element is locatable about the pump shaft.

6. A pump insert as claimed in any preceding claim, wherein the closure element is locatable directly between the pump insert and the pump casing.

7. A pump insert as claimed in any one of claims 1 to 5, wherein the closure element is locatable between the

pump insert and a pump casing adaptor plate, wherein the pump casing adaptor plate is secured to the pump casing.

8. A pump insert as claimed in any preceding claim, wherein the pump insert is adapted to be coupled directly with the casing by the inter-engaging profiled coupling arrangement.

9. A pump insert as claimed in claim 7, wherein the pump insert is adapted to be coupled with the pump casing adaptor plate by the inter-engaging profiled coupling arrangement.

10. A pump insert as claimed in any preceding claim, wherein the pump closure element defines a portion of a pump shaft sealing arrangement.

11. A pump insert as claimed in any preceding claim, wherein the pump insert is firmly secured with the pump casing by the inter-engaging profiled coupling arrangement.

12. A pump insert as claimed in any one of claims 1 to 10, wherein the pump insert is adapted to be loosely coupled with the pump casing by the inter-engaging profiled coupling arrangement, and the pump insert adapted to be firmly secured in place within the pump casing when the pump is fully assembled.

13. A pump insert as claimed in any preceding claim, wherein the inter-engaging profiled coupling arrangement comprises at least one coupling element connected to the pump insert and at least one coupling element connected to the pump casing, wherein the respective coupling

elements are complementary and are adapted to be engaged to couple the pump insert with the pump casing.

14. A pump insert as claimed in claim 13, wherein the coupling elements are complementary teeth.

15. A pump insert as claimed in claim 14, wherein one coupling element is a tooth, and the other coupling element is a complementary slot adapted to receive the tooth.

16. A pump insert as claimed in claim 13, 14 or 15, wherein a plurality of coupling elements are provided.

17. A pump insert as claimed in any one of claims 13 to 16, wherein the coupling elements of the pump insert are integrally formed therewith.

18. A pump insert as claimed in any one of claims 13 to 16, wherein the coupling elements of the pump insert are formed separately of and subsequently connected to the pump insert.

19. A pump insert as claimed in any one of claims 13 to 18, wherein the coupling elements of the pump casing are integrally formed therewith.

20. A pump insert as claimed in any one of claims 13 to 18, wherein the coupling elements of the pump casing are formed separately and subsequently connected to the pump casing.

21. A pump insert as claimed in claim 20, wherein the coupling elements of the pump casing are integrally

formed with a pump casing adaptor plate with the adaptor plate being secured to the pump casing.

22. A pump insert as claimed in any one of claims 13 to 21, wherein the coupling elements of both the pump insert and the pump casing are located on and extend from a respective element support surface of the pump casing and pump insert.

23. A pump insert as claimed in claim 22, wherein the coupling elements of the pump casing and the pump insert extend from their respective element support surface in a radial direction.

24. A pump insert as claimed in claim 22 or 23, wherein the coupling elements of the pump casing pump insert extend in opposite radial directions from the respective element support surfaces.

25. A pump insert as claimed in any one of claims 13 to 24, wherein each coupling element of the pump insert is adapted to slidably engage a respective coupling element of the pump casing.

26. A pump insert as claimed in any one of claims 13 to 25, wherein each coupling element of the pump insert includes an engaging surface adapted to engage a corresponding engaging surface of a respective coupling element of the pump casing.

27. A pump insert as claimed in claim 26, wherein each engaging surface of each coupling element of the pump casing and pump insert defines a wedge profile.

28. A pump insert as claimed in any one of claims 13 to 27, wherein the pump insert is coupled with the pump casing by rotationally misaligning the coupling elements of the pump insert and the pump casing, bringing together the pump insert and pump casing, and rotating the pump insert with respect to the pump casing to cause sliding engagement of the coupling elements of the pump casing and pump insert respectively.

29. A pump insert as claimed in any one of claims 13 to 27, wherein the coupling elements of the pump insert is engaged with the coupling elements of a pump casing adaptor plate, which adaptor plate subsequently being secured to the pump casing.

30. A pump insert as claimed in any one of claims 13 to 27, wherein the coupling elements of the pump casing and pump insert are rotationally aligned, as required, with the pump casing and pump insert being brought together in the required fashion to engage the coupling elements.

31. A pump insert as claimed in any preceding claim, wherein the pump insert comprises an annular portion and a cylindrical portion, wherein the cylindrical portion extends substantially perpendicular from an outer surface of the annular portion.

32. A pump insert as claimed in claim 31 when dependent on claim 22, wherein the cylindrical portion defines the coupling element support surface of the pump insert.

33. A pump insert as claimed in any preceding claim, wherein the pump insert is adapted for use on both lined and unlined pumps.

34. A pump insert as claimed in any preceding claim, wherein the inter-engaging profiled coupling arrangement is a bayonet type fitting.

35. A pump insert as claimed in any preceding claim, wherein the pump insert is adapted for use with a centrifugal pump.

36. A method of assembling a portion of a pump including, at least, a casing having a coupling element, a pump insert having a complementary coupling element, and a pump casing closure element, said method comprising the steps of:

locating the pump casing closure element between the casing and the pump insert;

aligning the coupling element of the pump insert with the coupling element of the pump casing; and

causing relative rotational motion of the pump insert and the casing to cause the complementary coupling elements to engage and couple the pump insert with the casing and secure the pump casing closure element therebetween.

37. A method of assembling a portion of a pump as claimed in claim 36, wherein the pump insert is loosely coupled with the pump casing by engagement of the coupling elements.

38. A method of assembling a portion of a pump as claimed claim 36 or 37, wherein the method comprises the steps of:

locating the pump casing closure element between the pump insert and a pump casing adaptor plate; and

aligning the coupling elements of the pump insert with complementary coupling elements of a pump casing adaptor plate and rotating the pump insert with respect to the adaptor plate to cause the coupling elements to engage, wherein the adaptor plate is subsequently secured to the pump casing.

39. A method of assembling a portion of a pump as claimed in claim 36, 37 or 38, wherein the closure element is located between the casing and the pump insert when used in a lined pump having a split casing, such that the method involves the steps of locating a first portion of a pump casing about a shaft, locating a closure element and a pump insert about the shaft with the closure plate located between the pump insert and pump casing, and engaging the complementary coupling elements to couple the pump insert with the casing first portion and secure the closure element between the pump insert and casing.

40. A method of assembling a portion of a pump as claimed in claim 39, wherein the closure element is loosely secured between the pump insert and the casing.

41. A method of assembling a portion of a pump as claimed in claim 39 or 40, wherein the method further comprises the steps of locating a pump liner within the first portion of the casing and against the pump insert, and securing a second portion of the casing to the first portion such that the liner is forced against the pump insert resulting in the coupling elements being at least partially separated and the pump insert being clamped between the liner and the closure element, and the

closure element being clamped between the pump insert and the first portion of the pump casing.

42. A method of assembling a portion of a pump as claimed in claim 36, 37 or 38, wherein the closure element is located between a pump casing adaptor plate and the pump insert when used in an unlined pump, such that the method involves the steps of locating the adaptor plate about a pump shaft, locating the closure element and the pump insert about the pump shaft with the closure element being located between the adaptor pate and the pump insert, and engaging the complementary coupling elements to couple the pump insert with the adaptor plate and secure the closure element between the pump insert and adaptor plate.

43. A method of assembling a portion of a pump as claimed in claim 42, the method further comprises the step of securing a pump casing to the adaptor plate such that the closure element forces the pump insert against the casing resulting in the coupling elements being separated and the pump insert being clamped between the casing and the closure element, and the closure element being clamped between the pump insert and the pump casing adaptor plate.

44. A pump closure assembly comprising:

a pump insert located about a pump shaft and coupled with a pump casing by an inter-engaging profiled coupling arrangement, wherein an inner surface of the pump insert defines a portion of a pump volute; and

a pump casing closure element located about the pump shaft and secured between the pump insert and the pump casing when said pump insert and pump casing are coupled

together by the inter-engaging profiled coupling arrangement.

45. A pump closure assembly as claimed in claim 44, wherein the closure element is directly secured between the pump insert and the pump casing.

46. A pump closure assembly as claimed in claim 44, wherein the closure element is secured between the pump insert and a pump casing adaptor plate which is adapted to be secured to the pump casing.

47. A pump comprising:

a pump casing;

a pump insert located within the pump casing and having an inner surface which in use defines a portion of a pump volute, wherein said pump insert is adapted to be coupled with a pump casing by an inter-engaging profiled coupling arrangement; and

a pump closure element secured between the pump insert and the pump casing.

48. A pump as claimed in claim 49, wherein the closure element is directly secured between the pump insert and the pump casing.

49. A pump as claimed in claim 47, further comprising a pump casing adaptor plate adapted to be secured to the pump casing, wherein the pump insert is adapted to be coupled with the adaptor plate by the inter-engaging profiled coupling arrangement with the pump closure element secured therebetween.

50. A pump insert having an inner surface which in use defines a portion of a pump volute, wherein said pump insert is adapted to be coupled with a pump casing adjacent a suction branch thereof by an inter-engaging profiled coupling arrangement.

51. A pump insert as claimed in claim 50, wherein the pump insert provides a flow path between the suction branch of a pump casing an a pump impeller.

52. A pump insert as claimed in claim 50 or 51, wherein a portion of the pump insert is adapted to be secured against a pump casing closure element.

53. A pump insert as claimed in claim 52, wherein the pump casing closure element defines a portion of a pump suction branch sealing arrangement.